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Full year of continuous N2O flux measurements in a drained agricultural peatland in northern Finland

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Pristine boreal peatlands are often considered neutral or even small sinks for nitrous oxide (N2O). However, drained peatlands are a significant source of N2O. In these managed sites, oxygen becomes more available, increasing denitrification and therefore N2O release into the atmosphere. N2O emissions do not typically follow a strong seasonal pattern like carbon dioxide but instead, have high spatial and temporal variability. Short-term N2O peak emissions can be observed after various meteorological or soil management events throughout the year, for example after soil freezing or thawing, or fertilization. However, it is not well known how exactly those events trigger the N2O emission peaks. Therefore, N2O annual budget based on punctual chamber measurement can introduce large uncertainties. That is why it is important to measure N2O emissions with a continuous method to better understand the controlling factors and to estimate the annual budgets more accurately.

For the first time in the boreal region of Europe, N2O emissions were continuously observed during a full year in a drained agricultural peatland with the eddy covariance (EC) technique. The study site is a managed peatland in northern Finland, in Ruukki (Latitude: 64.684010; Longitude: 25.106473), with a peat depth between 10 and 90 cm. It is currently managed as a grass field, composed of a mixture of timothy and meadow fescue. We will show a first overview of the N2O fluxes measured since November 2019 with the EC technique. We will present how various meteorological and management events can explain some short-term variations. Then, we will compare the N2O annual budget estimated from the EC measurements to the IPCC emission factor and to different estimates achieved using several sets of non-continuous data points, representing manual chamber measurements with varying frequency.